The Development and Testing of the Improved Kinetic Energy Electronic Time (IKE-ET) Round

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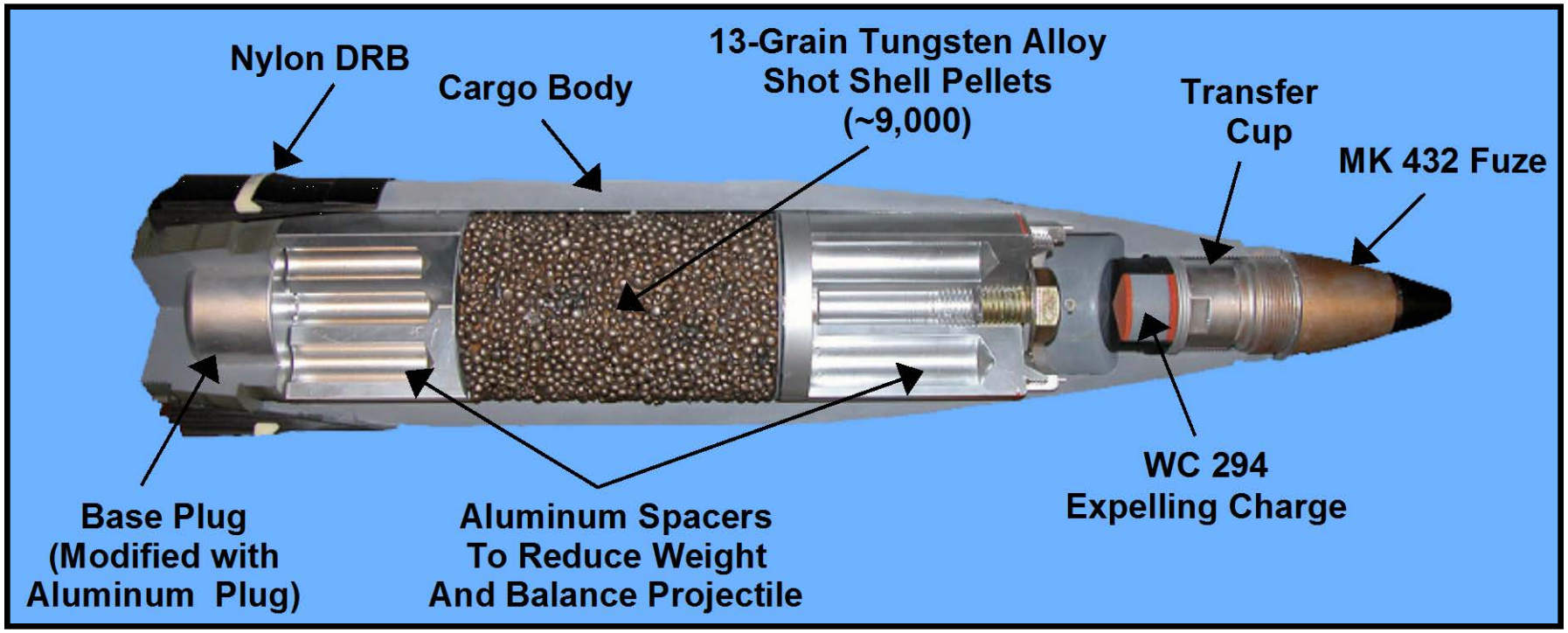
Requirement and History

- In response to Task Force Hip Pocket requirements to address the small boat threat, cargo projectile bodies were used to develop KE-ET (2 July 2003).
- KE-ET design was a result of a quick turn around demonstration program.
- IKE-ET was proposed to replace KE-ET with more accurate time variation and greater lethality.
- Veritay Technology Inc. was awarded SBIR contract in 2004, and has been developing the projectile design.
- IKE-ET program recently completed a Phase III SBIR funded by ONR's Rapid Innovation Funds Program (RIF).

MK 182
KE-ET Anatomy

- The MK 182 KE-ET is currently fielded in the fleet
- KE-ET: The pellets lose kinetic energy by being expelled from the base



IKE-ET Anatomy

MK 437 Fuze

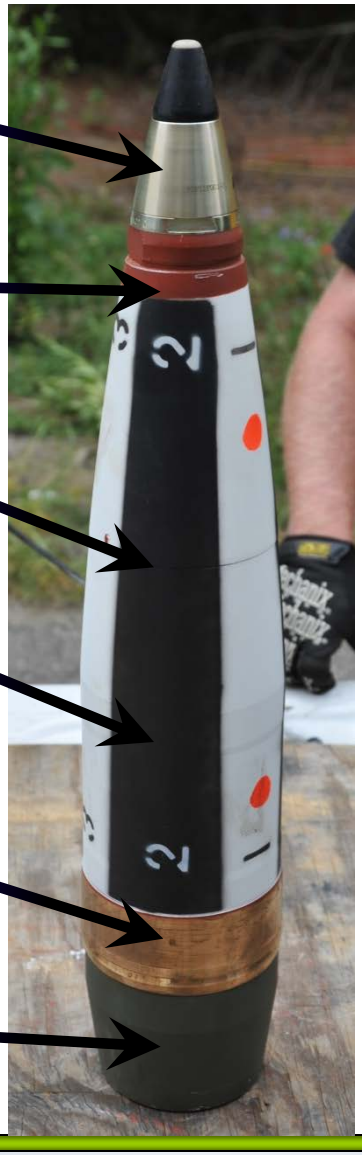
Nose Removal Charge

Nose Joint

Tungsten Pellet Payload

Copper Rotating Band

Payload Expulsion Charge



- IKE-ET: The pellets gain kinetic energy by being expelled from the nose *(Developed by Veritay)*
- Switched from KE-ET's payload of 13 grain tungsten pellets to 3/8th inch tungsten spheres (~130 grain) used in the Army's M1028 round

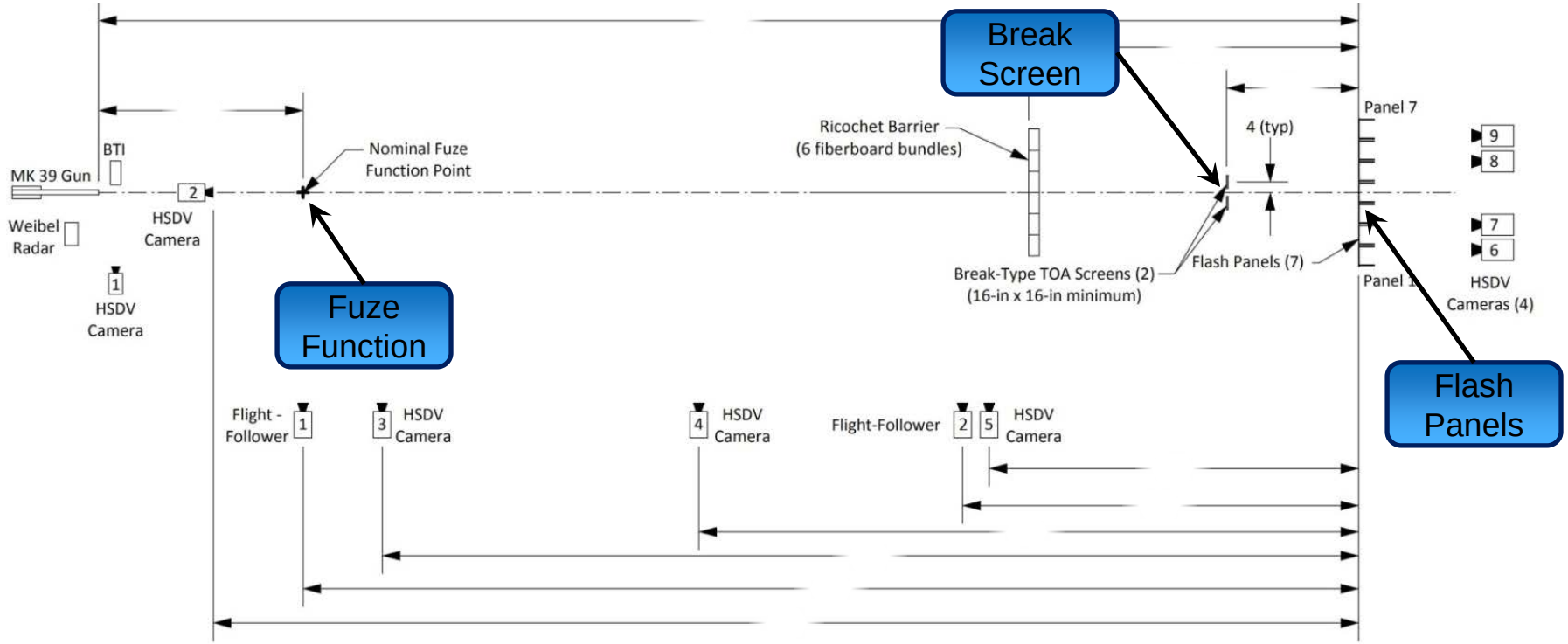
IKE-ET Testing

- RIF program included:
  - Survivability and expulsion test
  - Dynamic arena tests to obtain dispersal data for lethality analysis
  - Live test of target on the river out of a MK45 Mod 2 - 5 inch gun

Dynamic Arena Test

- Purpose
  - Verify gun launch survival and flight stability
  - Verify nose separation functionality
  - Fuze function and payload expulsion time
  - Determine fragment velocity and spatial distribution data (Z-data) to support lethality analysis
- Normal (static) method of collecting Z-data is to set off the projectile/warhead in a circular enclosure and capture fragment velocity and direction data
- The IKE-ET design does not lend itself to this method of data acquisition since:
  - Spin of projectile is a major part of the dispersal mechanism
  - Spin can only be achieved through gun launch

Arena Test Layout and Methodology



- Projectile fuzes at function point
- Pellets pass through break screen signaling the flash panels
- Flash panels timed to flash when pellets are predicted to pass through
- High speed cameras capture moment of pellet impact
- Data is used to calculate both velocity and dispersion of pellets

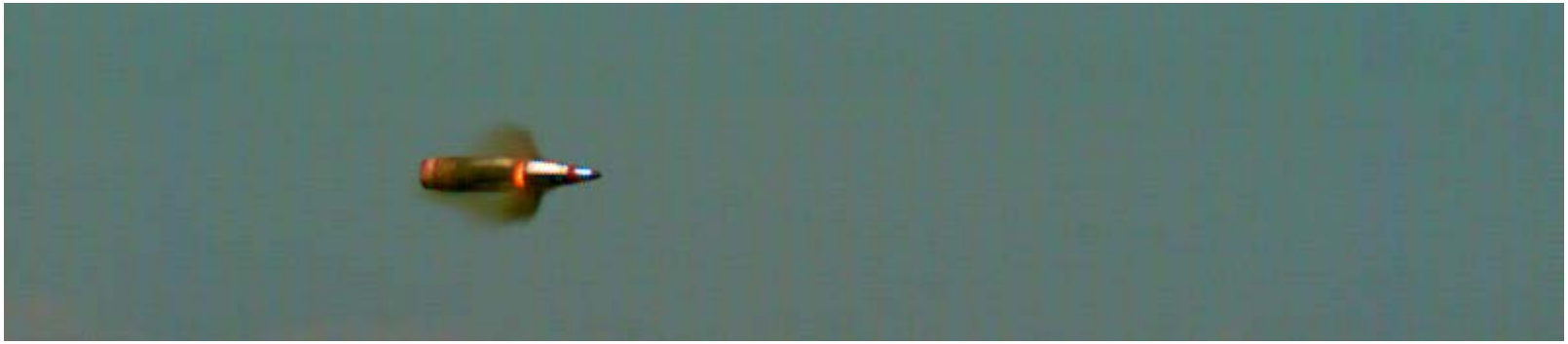
Arena Test Setup

Front of Flash Panels

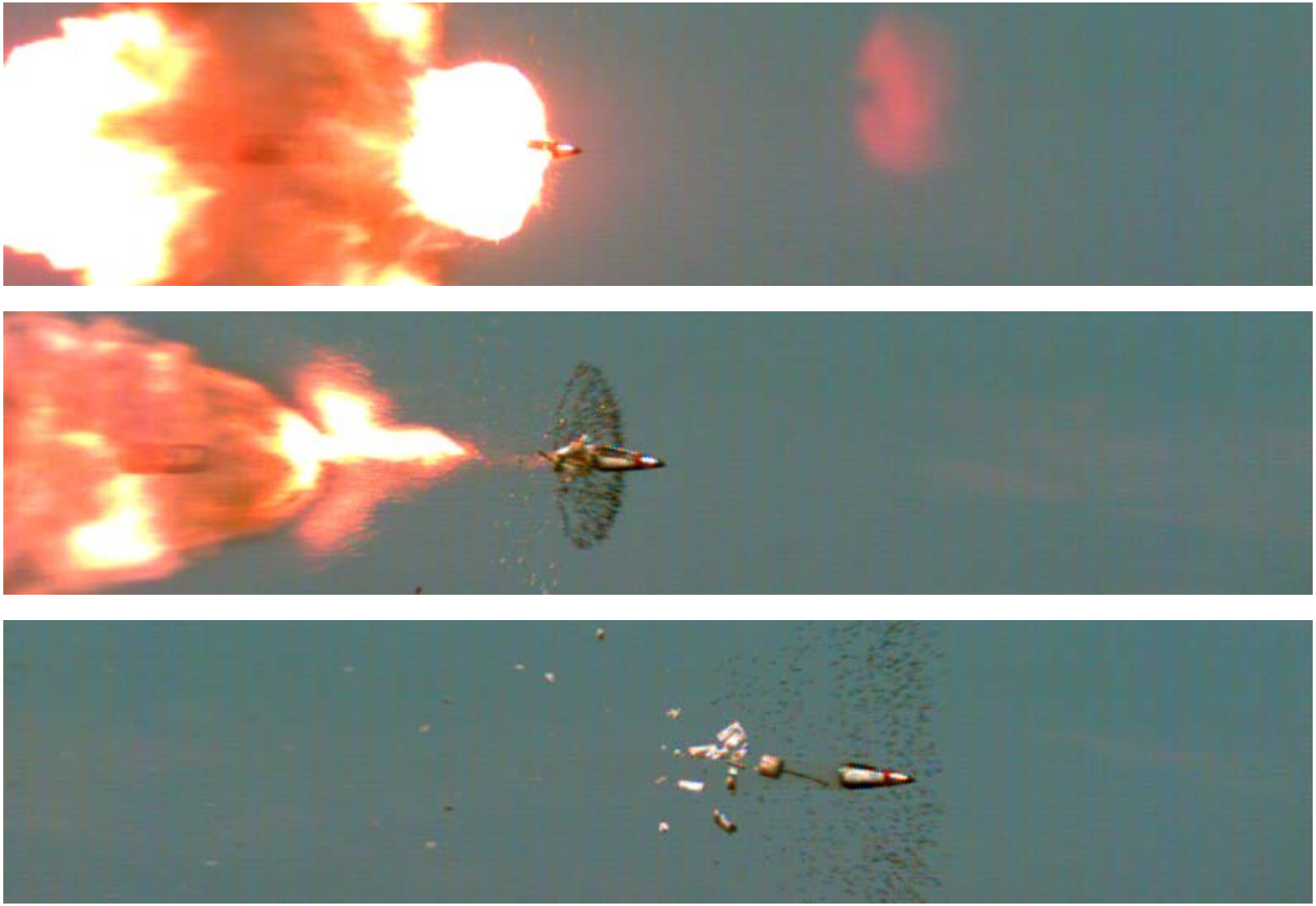
Rear of Flash Panels

Flash panel construction is foam insulation board on front side and aluminum plate on rear with flash bulbs placed in between

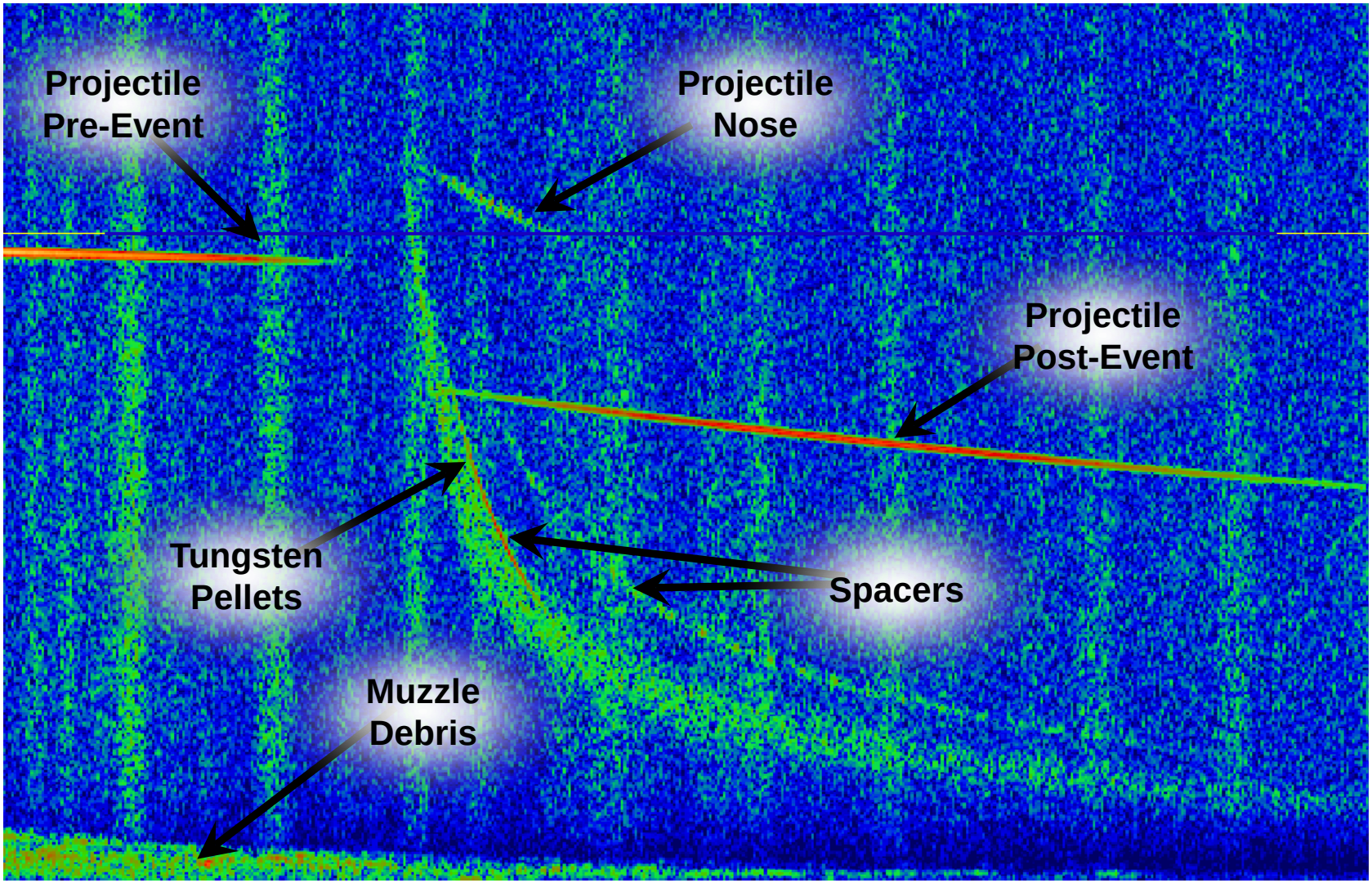
Test Photos (Nose Separation)



Test Photos (Payload Expulsion)



Sample Radar Plot



Live Fire Test

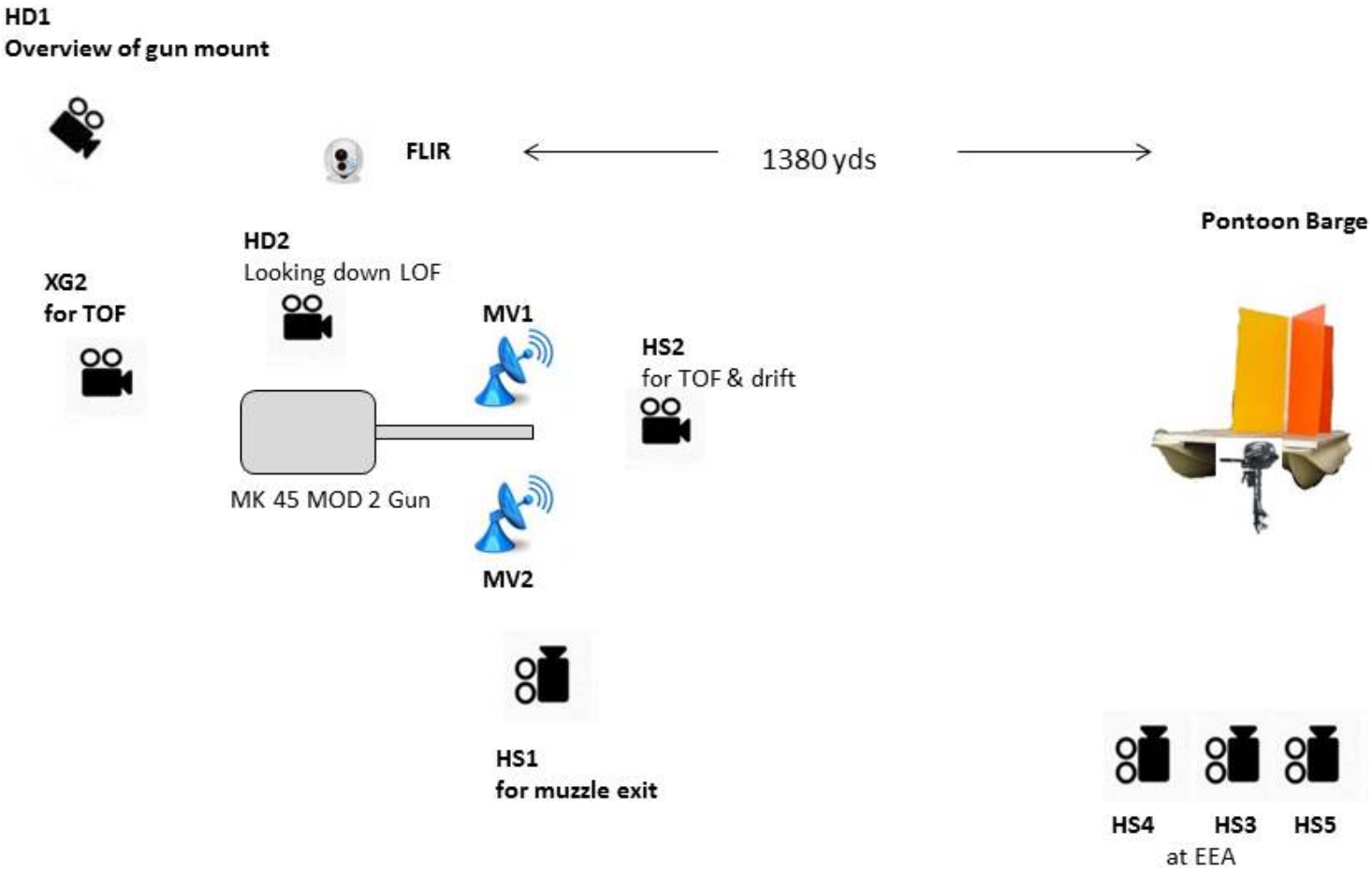
- Veritay and NSWCDD partnered together to demonstrate the IKE-ET projectile by firing it at a realistic target in a relevant operational environment
- Test used the Mk45 Mod 2 gun against a target on the river at a range of 1380 yards
- The target was a pontoon barge loaded with an aluminum and steel cruciform
- Video and structural data was generated from this test
- Successful completion of this test resulted in the program achieving TRL 6+

Live Fire Test Setup

- Seven IKE-ETs were fired (all fuzed with Mk437 MOFN)
  - First two used to test engineering fixes (no target, contained Hevishot)
  - Remaining five contained ⅜ in. tungsten spheres payload
- Five KE-ETs were fired for comparison

- Two pontoons barges were used (one each for IKE-ET and KE-ET)
- Targets were placed at 1380 yards
  - This was due to the minimum gun QE
- Barges were initially placed head on for the first two successful shots and then rotated 90° for the remaining shots
- High-speed (HS) digital video cameras and a Forward-Looking Infrared (FLIR) camera were used to record video of the round functioning and affects on the target

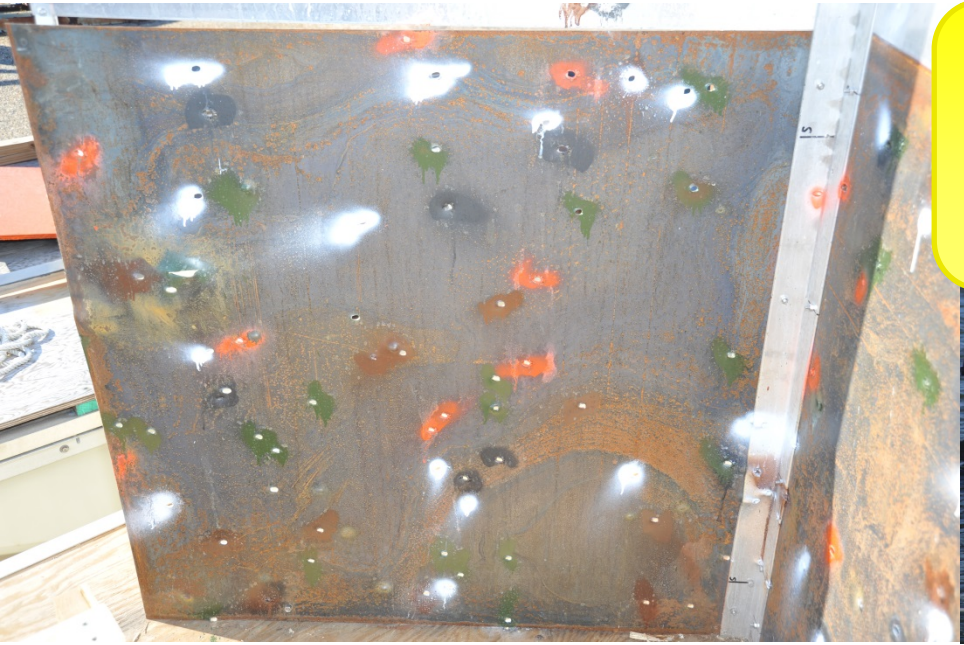
Live Fire Test Layout



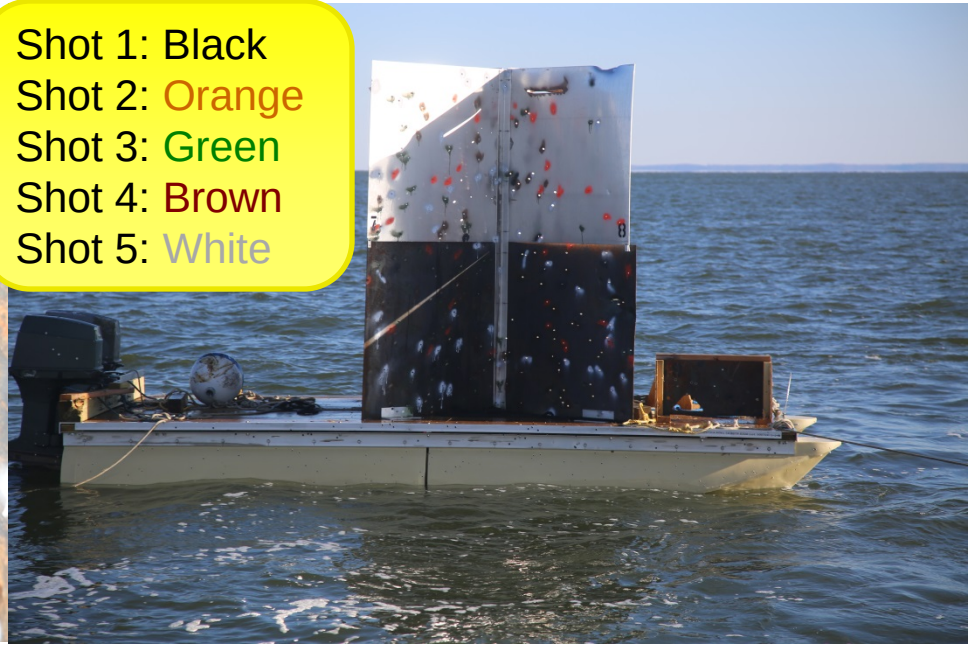
Live Fire Test Target Setup

- 16 x 8 ft. pontoon barge
- 8 x 8 ft. cruciform
  - ⅛ in. 3003 aluminum panel (top)
  - 11 gage hot rolled steel panel (~⅛ in.) (bottom)
- 5.6 x 8 ft. = 45.25 ft² presented area from front and side
- Two 85 HP outboard motors mounted on stern
- 1 x 2 ft. and 1 x 1 ft. ½ in. steel plates mounted on bow of target (smaller plate set at a 45° angle)
- Steel plates are common structural A36 standard alloy

IKE-ET Target Damage



Shot 1: Black
Shot 2: Orange
Shot 3: Green
Shot 4: Brown
Shot 5: White



- ⅜ in. tungsten spheres clearly penetrated both steel panels in the cruciform
- Several penetrated the ½ in. steel plate

Questions?